Dynamic Selection of Three-Dimensional Interface Patterns in Directional Solidification

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Objective:

- Understanding of dendrite evolution has been dramatically increased by microgravity experiments, principally in undercooled pure materials
- Understand the dynamics that lead to uniform and reproducible three-dimensional pattern formation in materials, particularly alloys
- Obtain benchmark data required for establishing the detailed dynamics of interface pattern selection during the solidification of alloys
- A fundamental understanding of interface dynamics is central to tailor microstructures to optimize materials properties

Relevance/Impact:

- Many industrial applications involve directional solidification
- Pattern formation is vital for controlling microstructure during solidification of high temperature, high strength, complex alloys, and in welding and other molten metal forms of joining
- Applicable to cryofreezing of biological system (e.g. blood) where homogeneity is necessary. There are implications for human exploration missions.

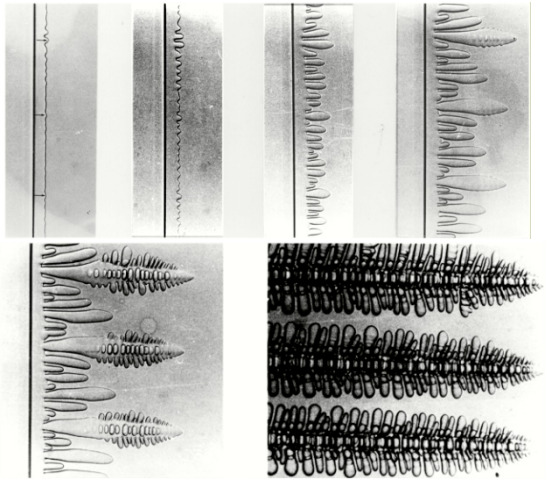
Development Approach:

- Transparent alloy of succinonitrile will be used as an analog of metallic alloys
- Sample will be observed by microscopy, interferometry with a resolution of 5 microns with a sampling rate – up to 25Hz
- Samples can be re-run at various solidification rates and with various temperature gradients. US PI will select his own experimental conditions.

DECLIC - Dispositif pour l'Etude de la Croissance et des Liquide Critiques. Accommodation will be CNES's DECLIC equipment housed within an EXPRESS rack. DSI, Directional Solidification Inert will be used.

Ground-based Research:

Development of cells to deep cells to dendrites, seen in directional solidification of a transparent plastic alloy analog. Low temperature furnace used. Pertinent data are overwhelmed by gravitational effects.



ISS Resource Requirements

Accommodation (carrier)	DECLIC
Upmass (kg) (w/o packing factor)	0 (zero) for samples (shipped with DECLIC
Volume (m^3) (w/o packing factor)	10e-8
Power (kw) (peak)	TBD
Crew Time (hrs) (installation/operations)	4
Autonomous Operation	TBD
Launch/Increment	TBD

Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
Actual/ Baseline	11/03							06/09 17A			